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PRECIPITATION IN RELATION TO INSECT PREVALENCE AND DISTRIBUTION.

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In this paper an attempt is made to draw attention to a few instances of how humidity, chiefly in the form of rain or snow, has been and is instrumental in either aiding or curtailing the spread of insects over the country, particularly in the Prairie Provinces.

There are very few insects, if any, that can live through all their stages without the aid of moisture. Most of them, indeed, are very much dependent upon it, especially in their larval stages. Numerous examples could be given, and a suitable one is provided in the various races of Tiger Beetles (*Cicindela*). We find these beetles from haunts in close proximity to water, to habitations on plains of drifting sand, apparently far removed from it; yet an examination a few inches below the surface, in the latter place, will show that the sand, if not equally moist, is at least sufficiently so for the wants of the beetle larvae, which are easily able to burrow down to it. There are occasions, however, when the insects' prairie haunts become very dry; at such times there is reason to believe that some of the larvae perish while the remainder retire to the bottom of their burrows and remain inactive until such time as rain once more moistens the soil.

While most insects require water in some form or other, there are certain kinds which seem to thrive best when it is least prevalent, and are only found in the driest situation. In this class we have most of our locust pests, and the celebrated Rocky Mountain Locust (*Melanoplus spretis*) supplies a good example. This locust, as is well known, has caused enormous losses in years gone by and has invaded our territory on more than one occasion. There is somewhat of a mystery surrounding this insect at the present time

which may, indeed, never be solved. We know that its breeding grounds once extended over a very wide area, much of this having been classed as permanent by Riley and others who investigated the plague at that time. At present, however, the insect seems to have vanished completely. Indeed, there are some who would place it with the Passenger Pigeon as an object of the past. It seems almost incomprehensible, however, that such can be the case. More probably the real permanent breeding grounds are more restricted than was supposed, and the locust will yet be located either by the discovery of its real haunts or by a new invasion following favourable weather conditions for breeding purposes. This, however, is beside the question. What I wanted to point out was that the Rocky Mountain Locust always invaded Western Canada during a dry season, arriving in swarms from elsewhere in July or August. As this was the time of oviposition, eggs were soon deposited in vast numbers, and, as a result, crops naturally suffered much more the following year than they did on the insects' first appearance. While the locusts were able to breed for a season or so in the invaded territory they seldom remained long. Frequently an excess of moisture to what they had been accustomed to produced sickness from which many died, while others taking advantage of sunny days and favourable breezes drifted to parts unknown.

In other words, dry weather had enabled them to overstep their usual breeding grounds, only, however, to be driven out or killed by a return to normal climatical conditions. The same dryness which induced an invasion of Rocky Mountain locusts was also instrumental in increasing the indigenous species of *Orthoptera*, so that such kinds as the Lesser Migratory Locust (*M. allanis*) became almost as destructive as its close relative mentioned above, while many other species were sufficiently numerous to aid materially in the work of destruction. We have another example of an insect's control by conditions of humidity alone in the Western Wheat-stem Sawfly (*Cephus sp.*). In this instance a lack of precipitation causes a dearth of the flowering stems of grasses in which the larval life is passed, resulting in a decrease of the species in proportion to prevalence of suitable grass stems for breeding purposes. This, of course, relates to natural conditions before

the husbandman made his appearance. The sowing of cereals has altered matters so that when the grasses fail to produce stems the saw-flies were able to continue their increase by attacking wheat and rye, with the result that they are now a serious pest.

Yet another insect which is checked by lack of moisture is the Hessian Fly. Dry seasons are generally recognized as anti-fly years and in Manitoba the partial second brood is frequently destroyed outright by a premature ripening of the grain, due to dry, hot weather conditions in late July. A knowledge of this fact is often of the greatest importance in forecasting as to the probabilities of a Hessian-Fly outbreak. It also comforts us in the thought that weather conditions will seldom remain favourable to the insect for any length of time, though we have the unpleasant knowledge that good crop years are frequently best adapted to Hessian-Fly increase. Moisture is probably still more important over northern latitudes in the form of snow when it provides a thick covering to the objects beneath, protecting them from both frost and sun. It is really astonishing how a blanket of snow will afford protection even to the tender plants. For instance, potatoes have more than once survived the winter, even in our invigorating Manitoba climate where the temperature, at times, attains a minimum of fifty below zero. Yet expose these same potatoes directly to four or five degrees of frost and they will present a sorry spectacle next morning.

Snow is unquestionably a very important factor in preserving insect life in winter time, and there is no doubt that it is largely responsible for the preservation of many forms which would perish without its covering. Perhaps there is no better example of its preserving influence than was shown by the Colorado Potato Beetle. This beetle invaded Manitoba a number of years ago, but did not become a serious pest until comparatively recent times. It had, however, gradually extended its range northward. In 1913 its ravages were severely felt in Southern Manitoba as far north as latitude 50° and to a lesser degree for some distance farther north. In the winter following, that is 1914-15, there was a great scarcity of snow in portions of the province so that some places used wheels throughout the winter. The result of this lack of snow was that the frost penetrated considerably deeper into the ground than

usual. While an occasional thaw came in direct contact with the surface, thus providing a thawing and freezing condition known to be detrimental to insect life, there is no doubt that several species suffered in consequence, but the Colorado Potato Beetle, as a rule, burrows sufficiently deeply to escape the thawing effect, hence frost alone was to be reckoned with.

The result of this lack of snow was very marked the following May. Beetles which had gone into winter quarters in a healthy condition were found huddled together in a state of death, not a single living example being located in the more exposed situations, though later in the season odd individuals turned up on potato plants forming the nucleus for future generations. The country was by no means all affected in the same way; some parts had a light covering, others a foot or more. Consequently the amount of snow necessary for protection could be ascertained with reasonable accuracy. As was mentioned above, complete lack of snow, or less than three inches, did not afford sufficient covering for the beetles, the few survivors having probably sought shelter beneath some straw or brush pile. Where there was a depth of snow amounting to from four to six inches the survivors were considerably increased. At eight inches about half the beetles survived, while a foot or more of snow apparently produced complete immunity from frost.

In the vicinity of the Entomological Laboratory at Treesbank very few beetles escaped, which proved a great boon to potato growers. The effect of this winter killing is still very marked (1916), less than one per cent. of the plants being infected. Near Winnipeg, on the other hand, where the snow fall was ample no mortality was noticeable among the beetles, and they have continued to be a serious pest there.

From the above account it is evident that snow plays an important part in the preservation of animal life, it also saves many a garden plant from destruction. Under normal conditions it will continue to afford protection to the Colorado Potato Beetle, but we can at least see that there will be years of severe check, like the winter of 1914-15. While there is every reason to believe that those portions of the country where snowfall is light will never prove a prolific breeding ground for that insect.

THE HEATH COLLECTION OF LEPIDOPTERA.

BY F. H. WOLLEY DOD.

(Continued from vol. XLVIII, p. 380.)

Anytus obscurus Sm. The palest specimens stood separated as *privatus*, of which *obscurus* is very likely only a suffused variation. The more suffused specimens stood as *profundus*, which Smith described from Manitoba as a species distinct from *obscurus*, the latter being described from Calgary on the same page. His subsequent attempt to prove the two distinct on genitalic characters is quite unconvincing. I use *obscurus* as the prior name by a page.

Anytus (Fishia) derelicta Hampson. Most of the specimens stood as *Hadena relecina* Morr., an old and widespread error which Heath had apparently never had corrected. One with paler secondaries than usual was separated as *yosemita* Grt., but wrongly. *Instruta* Smith, described from De Claire, Man., may prove to be a prior name to *derelicta*.

Ufeus satyricus Grt. Some specimens were separated as *plicatus* Grt.

Mamestra mystica Sm.

Mamestra imbrifera Gn. Heath repeatedly sent me this species as *rogenhaferi*, under which name there is a specimen in the Rutgers College from Winnipeg, apparently distinct from anything else known to me.

Mamestra purpurissata Grt. Mostly standing as *juncimacula* Sm.

Mamestra meditata Grt. Most of the specimens were near var. *columbia* Sm. Two specimens of *Tricholita signata* stood mixed with the series.

Mamestra lustralis Grt. var. *cervina* Sm. Smaller and duller than the typical form.

Mamestra segregata Sm. (syn. *gussata* Sm.) and var. *negussa* Sm.

Mamestra detracta Walk. var. *neoterica* Sm. Smaller and duller than the typical form of the species, as is so frequently the case with Manitoba races. One series stood as *goodellii*, and another as *acutetermina*. Two more specimens, one of them an unusually contrasting variety, stood elsewhere as *cuneata* Grt., which they in no way resembled.

March, 1917

Mamestra distincta Kbn. One female, without date.

Mamestra chunka Sm. One female, May 29th, 1913, standing in company with one *trifolii* Rott., and one *mutata* Dod, under the latter name.

Mamestra farnhami Grt.

Mamestra obesula Sm.

Mamestra atlantica Grt.

Mamestra radix Walk.

Mamestra subjuncta G. & R.

Mamestra grandis Bdv. Some under their correct name, and another series under *legitima* Grt.

Mamestra lubens Grt.

Mamestra trifolii Rott. Also a series of mottled specimens erroneously as "var. *trifolii*, var. *albifusa* Walk. *oregonica*."

Mamestra rosea Harv.

Mamestra picta Harris.

Mamestra assimilis Morr.

Mamestra adjuncta Bdv.

Mamestra lacoma Strk.

Mamestra lilacina Harv.

Mamestra goodelli Grt. var. *acuterminalis* Sm. Standing, (with one *Hadena plutonica*) as *neoterica* Sm. It must be readily admitted that *acuterminalis* and *neoterica* are often most puzzlingly alike in Manitoba, though I had not before imagined confusion possible. It was surprising how well Heath had them separated, though he had the names reversed. Two specimens of *acuterminalis* also stood apart as "*Noctua*, not identified by Smith."

Mamestra obscura Sm. Most of the series were more mottled with brown than is usual in Alberta specimens.

Mamestra renigera Steph.

Mamestra olivacea Morr. Smith described the race from this region as *lucina*, but I cannot see that the name is anything but a synonym of *olivacea*.

Mamestra lorea Gn.

Mamestra anguina Grt., (syn. *larissa* Sm.) A series standing as *larissa* were all correct. Of three specimens separated as *anguina*, one was this species, and the other two *cervina*; whilst of four specimens doing service for *incurva* Sm., two were *larissa* and

two *vicina*. It may here be remarked that mixtures of this kind were not infrequent in Smith's own collection, when I saw it in 1910.

Mamestra vicina Grt.

Barathra curialis Sm. Mixed with *Mamestra lubens*, to which it bears rather a close resemblance.

Dargida procinctus Grt.

Morrisonia evicta Grt. Standing as *sectilis*, which was probably Smith's error. The var. *vomerina* was correctly named. Holland, Pl. XXIV, pp. 13, 14, are of *evicta*, not *sectilis*, and fig. 14 is var. *vomerina*.

Xylomiges dolosa Grt.

Cardepia (Mamestra) mutata Dod. One specimen, but with *trifolii* and *chunka* wrongly associated with it, as mentioned under those headings. Sir George Hampson has critically examined my species, and tells me that it belongs to the genus *Cardepia*.

Nephelodes emmedonia Cram. (syn. *minians* Gn.) Dark specimens stood as *violans* Gn., and pale ones as *tertialis* Sm. The latter name is a pure synonym of *emmedonia*. *Violans* is a violaceous form of it.

Leucania unipuncta Harr.

Leucania luteopallens Sm. (= *pallens* Linn., probably). The species stood as *minorata* Sm., which is scarcely recognizable as a variety.

Leucania albilinea Hbn., (syn. *obscurior* Sm.)

Leucania dia Grt. Standing as *megadia* Sm., which is a variation possessing a black basal streak, an evanescent character.

Leucania multilinea Walk.

Leucania commoides Gn.

Leucania phragmitidicola Gn.

Orthodes crenulata Butl.

Orthodes cynica Gn.

Orthodes vecors Gn. Two badly worn specimens, one of them dated July 5th, 1907.

Himella contrahens Walk. The form here seems darker and more even than *infidelis* Dyar, and to be almost typical *contrahens*, though I am not satisfied as to their distinctness.

Crocigrapha normani Grt. One female, May 30th, 1912.

Eriopyga (Tæniocampa) uniformis Sm. Specimens stood under this name, and others were separated as *peredia* Grt. (= *furfurata* Grt.) and *communis* Dyar. There were none of the last named species in the collection. I am not assured of the distinctness of the other two, but the Manitoba form agrees better with *uniformis* than with true *furfurata*.

Eriopyga oviduca Gn.

Monima (Tæniocampa) hibisci Gn. (= *alia* Smith, etc., nec Guen.) Specimens stood in three different series, as *pacifica*, *instabilis* and *brucei*.

Monima revicta Morr. (*subterminata* Sm.) Five specimens, and one of *hibisci* wrongly associated with them.

Tricholita signata Walk. Standing correctly, and two specimens with *Mamestra columbia*.

Lithomoia germana Morr.

Graptolitha (Xylina) disposita Morr. A long and variable series, some of which stood wrongly as *hamina* Grt.

Graptolitha bethunei G. & R.

Graptolitha innominata Sm.

Graptolitha petulca Grt. Two stood with *amanda*, one of them dated Sept. 27th, 1904.

Graptolitha amanda Sm.

Graptolitha fagina Morr. Three specimens.

Graptolitha georgii Grt. Standing correctly, and also as *holocinerea*, *vertina*, *ancilla* and *oregonensis*. All are synonyms of *georgii*, with the doubtful exception of *oregonensis*.

Graptolitha unimoda Lint. Smith redescribed this from Manitoba specimens as *merceda*, though Heath had *tepida* under the latter name. This group of *Xylina* was badly mixed in the collection.

Graptolitha laticinerea Grt. Smith redescribed the species as *winnipeg*, but used to confuse it with *unimoda*. It must be admitted that the group is rather a difficult one.

Graptolitha cinerosa Grt. (syn. *grotei* Riley). Five specimens were found mixed with *laticinerea* and a few *unimoda*. The line between *cinerosa* and *laticinerea* is often very difficult to draw, and I have rarely, if ever, seen a collection in which they appeared to be correctly separated.

Graptolitha (Xylina) antennata Walk.

Graptolitha tepida Grt. Smith described it from Manitoba as *atincta*, creating an exact synonym.

Graptolitha pexata Grt.

Litholomia napæ Morr.

Xylotype (Xylina) capax G. & R. One poor specimen, Sept. 7th, 1905.

Calocampa curvimacula Morr.

Calocampa nupera Lint.

Calocampa cineritia Grt.

Calocampa thoracica Grt.

Cucullia asteroides Gn. Four specimens. I have a slide of the genitalia of one of them.

Cucullia omissa Dod. Six specimens, three of which I have made cotypes.

Cucullia postera Gn. Standing as *florea*.

Cucullia speyeri Lint.

Cucullia intermedia Speyer. Females stood correctly, but males were separated as *cinderella* Sm.

Rancora albicinerea Sm. A specimen of *Cucullia intermedia* stood under this name, but two of *albicinerea* stood apart elsewhere unlabelled.

Asteroescapus borealis Sm. There were no specimens of this very rare species in the collection, though the type was captured near Cartwright. There was, however, a large pencil drawing of the body and right wings, presumably of the type, labelled "Poplar catkins, Long River, Man., 1884, May 1st."

Bellura obliqua Walk. One pair, agreeing with Holland's figure.

Nonagria subflava Grt.

Tapinostola variana Morr.

(The Hydrocias and Papaipemas have been determined by Mr. Bird.)

Hydræcia velata Walk.

Hydræcia nictitans Linn. A short series were also separated as *juvenilis* Grt.

Hydræcia immanis Gn.

Hydræcia perobliqua Hamp.

Papaipema rigida Grt.

Papaipema harrisii Grt.

Papaipema purpurifascia G. & R.

Papaipema pterisii Bird.

Papaipema nebris Gn. Two specimens. Holland's figures of *nebris* and var. *nitela* are reversed.

Papaipema nelita Strck.

Papaipema frigida Sm., and var. *thalictri* Lyman.

Papaipema humuli Bird. Standing as *circumlucens* Sm.

Papaipema marginidens Gn. Standing as *rutila* Gn.

Pyrrhia cilisca Gn. Two pair. This is the *umbra* of North American collections generally.

Pyrrhia exprimens Walk. Two males and a female. An examination of male genitalia of this and the foregoing, mounted by Mr. Tams, has strengthened my opinion as to the distinctness of *cilisca* and *exprimens*.

Xanthia flavago Fab.

Mesolomia iris Gn.

Trigonophora periculosa Gn. and var. *v-brunneum* Grt.

Cinædia pampina Gn.

Scoliopteryx libatrix Linn.

Enargia (Cosmia) decolor Walk. (= *paleacea* Sm. non Esp.)

Enargia infumata Grt. (syn. *punctirena* Sm.)

Amathes (Orthosia) bicolorago Gn. and var. *ferruginoides* Gn.

Amathes verberata Sm.

Amathes puta G. & R. (syn. *curoa* G. & R.) A series as *curoa* and another as *dusca* Sm., which is the same species. This was also very badly mixed up with *Parastichtis discivaria*.

Amathes aggressa Sm. Two females. These two specimens, identified for me by Messrs. Barnes and McDunnough, appeared to be very obviously distinct from *puta*, being both large and pale. Other specimens which I have seen resemble that species much more closely. The difference in the male genitalia points to their being probably distinct.

Amathes inops Grt. A few were under their correct name. Some were mixed with *Tapinostola inquinata*, and scattered about amongst sundry other species.

Agroperina (Orthosia) lineosa Sm. and var. *pendina* Sm.

Agroperina lutescens Andrews. So standing were four of this species and one of *Scopelosoma sidus*. A large number were mixed up with other species, especially with *Euxoa scandens*. A series of *lutescens* and two *lineosa* stood as *inficita* Walk. (A prior name for *belangeri* Morr.)

Agroperina helva Grt.

Parastichtis discivaria Walk. Another badly mixed species.

Scopelosoma tristigmata Grt.

Scopelosoma sidus Gn. Standing as *walkeri*. The two are very difficult to separate, but I am not aware that *walkeri* occurs in Manitoba.

Scopelosoma devia Grt.

Glæa inulta Grt.

Epiglaea decliva Grt. Holland's figure under this name is probably *signata*.

Homoglaea hircina Morr.

Homoglaea carbonaria Harv. One specimen, Sept. 24th, 1910.

Calymnia orina Gn.

Ipimorpha pleonectusa Grt.

Copablepharon grandis Strk. One female, without date.

Heliothis armiger Hbn.

Heliothis phlogophagus Grt.

Rhodophora florida Gn.

Schinia cumatilis Grt.

Melaporphyria oregonica Hy. Edw.

Meliceleptria villosa Grt. One female, resembling Alberta specimens which I have identified.

Meliceleptria ononis Schiff. (syn. *septentrionalis* Hy. Edw.) One pair.

Plagiomimicus expallidus Grt.

Calpe canadensis Beth.

Panchrysia purpurigera Walk.

Plusia aroides Grt.

Plusia balluca Geyer.

Euchalcia venusta Walk.

Euchalcia contexta Grt. A single specimen was in the collection with no date or label on it of any kind.

Euchalcia putnami Grt.

Euchalcia bimaculata Steph.

Euchalcia biloba. One male, May 22nd, 1911.

Euchalcia californica Spezer. One female, standing as *pseudogamma*, with a specimen of the latter species sent to Heath by the author. It is strange to note the scarcity of *californica* in Southern Manitoba.

Euchalcia precationis Gn.

Euchalcia brassicae Riley.

Euchalcia flagellum Walk.

Euchalcia rubidus Ottol. A figure only, probably one of the types, as Cartwright was amongst the localities from which it was described.

Euchalcia ampla Grt.

Euchalcia falcifera Kirby, and var. *simplex* Walk. None of the specimens were very dark.

Abrostola urentis Gn.

Ogdoconta cinereola Gn.

Alleteria argillacea Hbn. One specimen, Sept. 30th, 1905, and associated with it, a bodiless worn specimen, probably *Agroperina lutosa*.

Rivula propinqualis Gn.

Erastria albidula Gn.

Erastria carneola Gn.

Erastria includens Walk.

Erastria panatela Sm. One male, without date, standing with *Tapinostola inquenata*.

Galgula paritid Gn. A single ♂. Dr. McDunnough said that this was var. *ferruginea*. My notes on *ferruginea* type (♂) say "a pale form, and reddish." It must not be confused with the dark vinous female of this species called *hepara*.

Lithacodia bellicula Hbn.

Xanthoptera semiflava Gn. A splendid series.

Acontia binocula Grt. Standing as *candefacta* Hbn.

Acontia candefacta Hbn. Standing as *erastricidae* Gn.

Spragueia tortricina Zell. A good and variable series. Mr. Wallis submitted this species to Mr. Gibson, and he said that it

was "*Fruva modesta*," and the dark form in the series may be *obsoleta*. I possess *tortricina* compared with the type, and have a note saying that *obsoleta* (also type) is probably the same species. Hampson makes *modesta* a dull form of *tortricina*, but he has not seen the type. I feel sure that *tortricina* at least is in the Heath collection.

Homopyralis contracta Walk.

Mycterophora slossonae Hulst. Dr. Dyar has found that this is a Noctuid genus.

Drasteria erechtea Cram.

Drasteria crassiuscula Harv. A good series of these two species, and as far as could be judged, fairly well separated. Males are not always separable without reference to the genitalia. Amongst both series were some peculiarly small forms.

Drasteria distincta Neum.

Euclidia cuspidea Hbn.

Melipotis nigrescens G. & R.

Melipotis versabilis Harv.

Syneda hudsonica G. & R.

(The Catoclas were determined by Messrs. Barnes and McDunnough.)

Catocala manitoba Beut.

Catocala crataegi Saund.

Catocala abbreviatella Grt., and var. *whitneyi* Dodge.

Catocala coccinata Grt.

Catocala cerogama Gn.

Catocala zoe Berh. Dr. McDunnough says that this is probably a good species, and not a variety of *ilia*.

Catocala parta Gn.

Catocala unijuga Walk., and var. *lucilla* Worthington. This latter is apparently on Mr. Beutenmüller's authority. Dr. McDunnough says that to his knowledge the name *lucilla* has not been published, but that the specimen in question is probably a faded variety of *unijuga*. *Lucilla* is unknown to me. In Smith's Catalogue it stands as a synonym of *unijuga*, apparently on the authority of Hulst. Sir George Hampson treats it as a synonym of *semi-relicta*.

Catocala meskei Grt. One specimen standing as "pura, dark form," and presumably so recorded by Heath.

Catocala briseis Edw.

Catocala faustina Strk. var. *verecunda* Hulst.

Catocala aspasia Strk.

Catocala concumbens Walk.

Catocala luciana Hy. Edw.

Catocala relicta Walk., and var. *clara* Beut.

Zale horrida Hbn.

Pheocyma lunata Dru. One very badly worn specimen.

Pheocyma minerea Gn. A considerable number under three names; one as *minerea*, the majority under *norda* Sm., which is a synonym, and three as "? *lineosa*."

Pheocyma galbanata Morr. (syn. *lineosa* Sm., nec Walk.) One specimen, standing as *lunifera*.

Pheocyma unilineata Grt.

Thysania zenalia Cram. One specimen of this migrant from the West Indies.

(The doubtful Deltoids were submitted to Messrs. Barnes and McDunnough.)

Epizeuxis lubricalis Hbn. There were large and small specimens, looking rather like two species.

Epizeuxis rotundalis Walk.

Epizeuxis americanalis Gn.

Epizeuxis amula Hbn.

Hormisa absorptalis. Two specimens.

Hormisa bivittata Grt. Two specimens.

Hormisa pupilloris Grt.

Philometra gaosalis Walk.,

Philometra hanhami Sm. Agrees with the description.

Chytolita morbidalis Gn. Mixed with *Renia flavipunctalis* Geyer, and *factiosalis* Walk.

Bleptina caradrinalis Gn.

Renia flavipunctalis Geyer.

Palthis angulalis Hbn.

Capis curvata Grt. Two specimens.

Bomolocha bijugalis Walk.

Bomolocha scutellaris Grt.

Bomolocha atomaria Sm. (syn. *chicagonis* Dyar.)

Bomolocha latalba Sm. A long series, including male and female cotypes.

Plathyphena scabra Fab.

Hypena humuli Harr.

Thyatiridæ.

Habroyne scripta Gosse.

Pseudothyatira cymatophoroides Gn., and var. *expultrix* Grt. Contrary to my former belief, evidence seems to point to the probability of these being forms of one species.

Euthyatira pudens Gn.

Notodontidæ.

Melalopha apicalis Walk.

Melalopha strigosa Grt. One specimen.

Melalopha albosigma Fitch.

Melalopha brucei Hy. Edw.

Datana ministra Dru.

Hyperæschra stragula Grt.

Hyperæschra georgica H. S. One male without date, identified for Heath by Dr. Dyar. It is much paler than Holland's figure, and the transverse lines contrast. Mr. Criddle's collection also contained a specimen of this very rare species.

Notodonta simplaria Graef. One specimen.

Odontosia elegans Strck.

Pheosia dimidiata H. S.

Lophodonta ferruginea Pack. One specimen, June 23rd, 1911. It is like Holland's figure, but darker and more even.

Lophodonta angulosa S. & A.

Nadata gibbosa S. & A.

Nerice bidentata Walk.

Symmerista albifrons S. & A. Two specimens, June.

Dasylophia anguina S. & A.

Heterocampa bilineata Pack. One male, June 22nd, 1901. Near Holland's figure, but even, greyish.

Ianassa lignicola Walk. Two, July 22nd, 23rd, 1905.

Schizura ipomææ Daub. Two females so standing. Var. *cinereofrons* Pack. A series of males stood thus, and Mr. Wallis informs me that the form is so named in his collection.

Schizura concinna S. & A.

Schizura semirufescens Walk., probably var. *perangulata* Hy Edw.

Schizura unicornis S. & A.

Schizura badia Pack.

Schizura leptinoides Grt.

Cerura scitiscripta Walk., var. *multiscripta* Riley.

Cerura occidentalis Lint.

Harpyia cinerea Walk.

Harpyia scolopendrina Bdv. As figured by Holland.

Glaphisia septentrionalis Walk.

Glaphisia sp. Two males, one dated June 3rd, 1905, apparently distinct from anything else known to me, but near *septentrionalis*. I compared a Winnipeg specimen with Packard's figures some years ago, and noted that it resembled *wrightii* as there figured, but it cannot be *wrightii*. I submitted a specimen to Messrs. Barnes and McDunnough, who said it was "nearest *lintneri* which we have from the same general region." It certainly is not *lintneri*.

Liparidæ.

Hemerocampa leucostigma S. & A.

Hemerocampa definita Pack. A series, agreeing with Holland's figure.

Alone vagans B. & McD., var. *grisea* B. & McD. This is the species which has always been widely known as *plagiata* Walk., but that species is the same as *definita* Pack. The form is normally brown or grey-brown, but some of the Heath specimens were very blackish grey.

Lasiocampidæ.

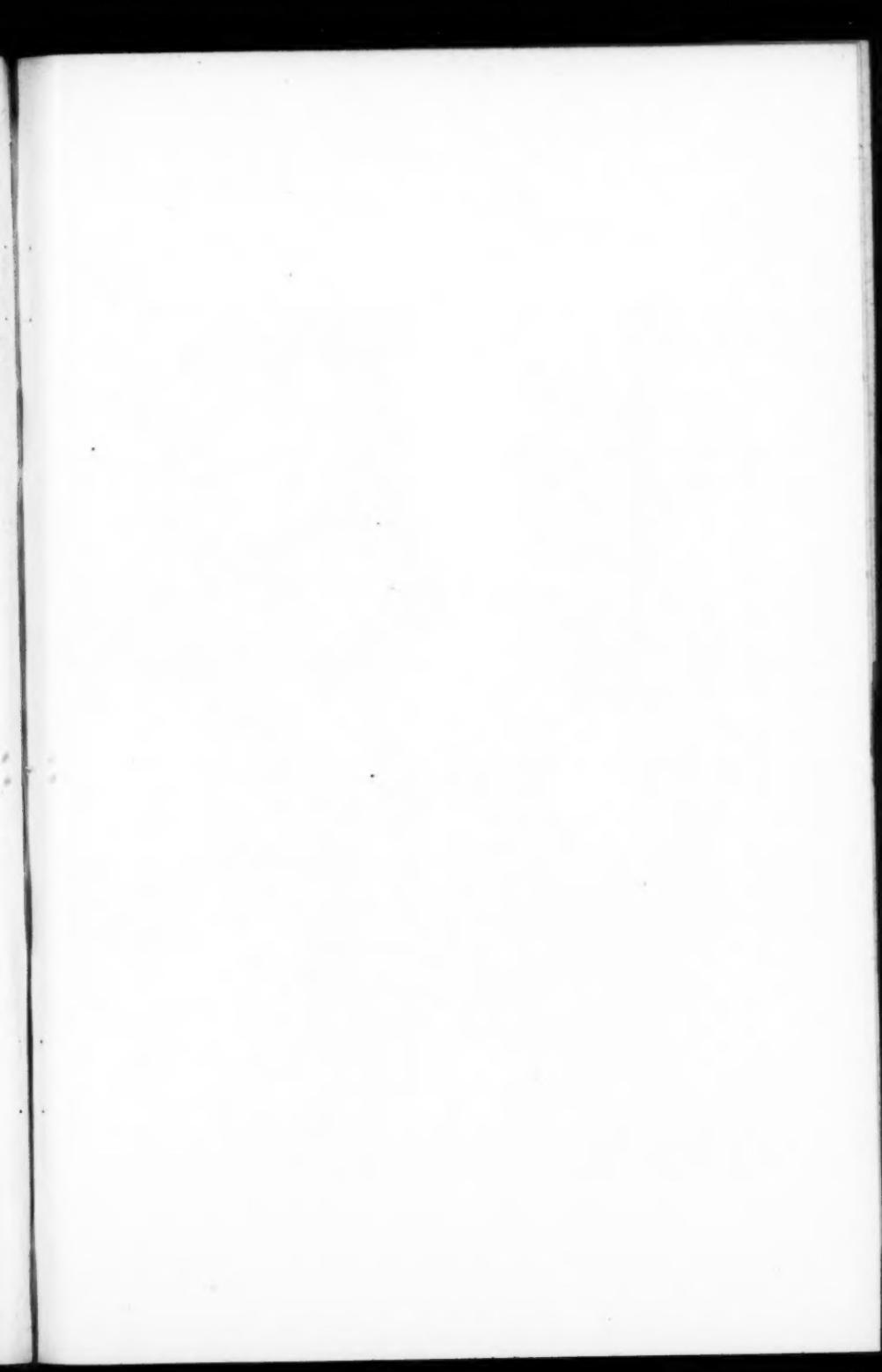
Malacosoma fragilis Stretch. The species was so named in the collection. I am not sure that *americana*, *fragilis* and *pluvialis* are always separable except by larval characters.

Platypterygidæ.

Oreta rosea Walk.

Drepana arcuata Walk.

Falcaria bilineata Walk.





PHALONIA SPARTINANA B. & McD.

(See p. 96)

A FEW NOTES ON THE LIFE HISTORY OF PHALONIA SPARTINANA.

BY C. N. AINSLIE, U. S. BUREAU OF ENTOMOLOGY.

This moth, recently described in the pages of the Canadian Entomologist* by Drs. Barnes and McDunnough, has been but once or twice taken in the open by the writer, but a number of adults have been reared in captivity at Elk Point, South Dakota. The species appears to cover a wide range of territory, for the larvæ have been found by the writer from the Canadian boundary to Southern Iowa, in fact the host grass, wherever it grows, seems to be infested by this insect.

The host grass, *Spartina michauxiana*, upon which the larvæ feed, occurs on low land and in swampy places, making a very rank growth. At times it attains a height of eight or nine feet, with a lower stem as large as a lead pencil or even larger. It is known as rope grass, or, locally, as red gut. In Eastern South Dakota the larvæ of this moth invade this grass very extensively, the infestation being as great in some places as 50%. The presence of the larvæ is shown, when the grass stem is split, by a fine, free, granular frass that loosely fills the gallery made by the borer.

The Egg.

The egg of the moth is of the disk type, so usual among the Tortricids. It is an irregular, flattened, disk-like form, ornamented by coarsely dotted radiating lines. A very few of these eggs have been seen, attached to the glumes of the *Spartina* head, the eggs being laid in ribbons of four or five, fastened together by their edges. The diameter of these disks is about .6 mm.

The Larva.

As soon as it leaves the egg the larva appears to feed first on the contents of the *Spartina* glumes, boring into one after another and devouring the anthers and stigmas of the undeveloped florets. After feeding for a week or more in this manner, it moves down to the stem, just below the base of the head and bores a circular opening into the stem after first spinning a slight silken shelter for itself for protection before it gets fairly inside. The opening it makes is about .75 mm. in diameter.

*Vol. XLVIII, 1916, p. 144.
March, 1917

One of the peculiar features of this species is the prodigality with which it sacrifices its individuals when very young. The young larvæ that feed in the glumes are to be numbered by the dozens in some of the infested heads, yet as far as the study of the species can determine, but one of these can survive in the course of the season. Several often find their way into the stem centre by separate openings, but invariably only one of these appears to survive. Several times one larva in a stem has been found feeding on a half-eaten rival. And it is certain that when winter comes there is but a single individual within each infested stem. Some explanation for this apparently useless expenditure of life may be discovered during future studies of this species, but at present it is an enigma. The reason why a single larva occupies an entire stem is clear, since a single stem affords nourishments for but one borer and self preservation compels the destruction of all competitors by the individual possessing the most vigour or the commanding position.

The parenchyma in the upper stem is unbroken and the gallery there is continuous. Farther down, the larva occasionally takes advantage of lesions in the parenchyma and passes sometimes for several inches with no sign of a mine. The nodes are, of course, solid and these are of necessity bored. Near the base of the stem there are few lesions, the larva is much larger, and the gallery is continuous.

The larva enters the stem during August, and by the middle of October, its progress depending upon the character of the season, it usually reaches the stem base. From lack of vitality or for some other reason a few of the larvæ always fail to reach the base before winter, and many, of these belated individuals perish during the winter. Those in the hibernation chamber underground appear to survive almost without exception. This chamber is merely the portion of the gallery at the very base of the stem. It is cleared of frass, often but not always lined with delicate, transparent silk, and here the larva hibernates until the middle of the following May. For two years the writer supposed this was also the pupation chamber, but before the end of May the stems are for the most part vacated, the guests disappearing through an opening eaten through the stem about ground level. A fortunate discovery solved the

mystery. It was learned that when the larvæ leave the hibernation cell they move at once to the fresh growth of the spring, the young grass shoots being then perhaps eighteen inches tall. These shoots are entered near their upper end, where the long blades coalesce into a spongy stem, and the larvæ of the previous year begin once more to feed upon the fresh and succulent interior of this growing sprout. Boring downward nearly to the ground they reach maturity, become sluggish, line a portion of frass-free gallery with a delicate silken tissue and pupate here some time early in July. At the time of pupation the larva measures from 15 mm. to 18 mm. in length, and is a half-transparent, watery green colour with sometimes a yellowish tinge.

The Pupa.

The pupa is a chestnut brown and measures about 12 mm. in length by 3 mm. in diameter. During emergence the moth drags the pupal envelope almost completely from the stem.

The Adult.

The first adult to be reared in captivity appeared in a cage July 19th, 1915. These moths continued to emerge during July and well into August, the last one being taken about August 15th. Several adults were captured on July 20th, 1916, in the vicinity of Spartina, near Sergeant Bluff, Iowa. In captivity the adults are good hidors, being difficult to find in a cage until they move, and they only move when much annoyed. They stand on grass blades or other perch with the head pointing upwards and will sidestep when disturbed, flying only as a last resort. In the open they take to wing with a quick, baffling flight which carries them a few feet. They make a dash for shelter, alight on a leaf or twig and whirl to the rear of their perch as quick as a flash. After one such flight they are easily dislodged again, and are not readily taken.

Beyond this note nothing is known of the habits of the adults, but they are evidently nocturnal fliers, judging from sundry observations.

Oviposition doubtless occurs soon after the emergence of the moths and studies of the Spartina heads indicate that the period of oviposition covers several weeks. The same seasonal causes that would delay the emergence of the moths would also tend to retard the heading out of the Spartina. A supply of glumes in

the proper condition for food for the newly hatched larvae naturally precedes the hatching of the eggs, and the time of oviposition must coincide with or very closely follow the emergence of the *Spartina* heads.

The antenna of the moth are, when at rest, carried under the wing, closely appressed to the side of the thorax and reach to about the third abdominal segment. The eyes are in some lights a greenish brown.

No parasites have as yet been reared from *Phalonia spartinana*.

EXPLANATION OF PLATE VI.

Upper right fig.—Adult and empty chrysalids of *Phalonia spartinana*, showing extension of pupa case during emergence ($x2\frac{2}{3}$, nearly).

Upper left fig.—Pupa of *P. spartinana* in situ in stem of *Spartina michauxiana* ($x3\frac{1}{3}$, nearly).

Lower fig.—Larvae of *P. spartinana* in situ in lower stem of *Spartina michauxiana* (x3).

THE ODONATA OF THE RED DEER DISTRICT, ALBERTA.

BY F. C. WHITEHOUSE, RED DEER, ALTA.

While the careful collecting of Dragonflies in the Red Deer District for the past two seasons has failed to produce any notable surprises, or, in fact, a very lengthy list of species, I nevertheless feel that it is not out of place to publish my observations in a district that, so far as this order is concerned, has never been worked before. It is, of course, altogether likely that thorough collecting over a number of years would tend to lengthen the list, but this, in my opinion, would not be to any very appreciable extent.

Red Deer (Canadian zone) is situated on the Red Deer River about half-way between Calgary and Edmonton, and has an altitude of 2,818 feet. The district is well treed with spruce, aspen (*Populus tremuloides*) and balsam-poplar (*Populus balsamifera*). Bordering on the city is a body of water, twenty acres in area, known as Gaetz Lake, and the Waskasoo Creek flows through the town site.

March, 1917

I am much indebted to Dr. E. M. Walker for identifying specimens and giving me much useful advice, and also in looking over this manuscript.

To Mr. C. B. Horsbrugh my sincere thanks are due for practical assistance in the collection of specimens. In this gentleman's ornithological studies he has ranged the district "far and often," and, owing to this careful scouting, the appearance of "something new" has been almost instantly noted.

The list is arranged according to Muttkowski's catalogue of the Odonata of North America, and the *second* numbers refer to pages.

Unless otherwise stated all dates apply to 1916.

Cœnagrionidæ.

LESTINÆ.

1-37 *Lestes congener* Hagen.

Tenerals appeared Aug. 4th, and by Aug. 27 adults were flying in numbers. I took specimens as late as Sept. 24.

A common insect here.

2-37 *Lestes disjunctus* Selys.

July 8, 1 ♂ and 2 ♀ tenerals and others observed. July 13-16, numbers flying; some nearly adult and tenerals. July 22, many adults. August 27, still on the wing. Last date, a single belated ♂, Sept. 14.

Very common.

3-39 *Lestes uncatus* Kirby.

First appearance July 2, a ♂ and 2 ♀ tenerals, and other tenerals seen by a run of still water behind Allen's House. July 5, a ♂.

I do not believe *uncatus* is as scarce as my scanty captures would indicate, but it is certainly the least common *Lestes* in this district. I took an adult ♀ in 1915, which was the first record for Alberta.

4-40 *Lestes unguiculatus* Hagen.

I failed to note the actual first appearance of tenerals. On July 19 I took 5 adult ♂'s, and a pair in cop., and by July 22 many adults were on the wing. The insect was flying in numbers at Blackfalds, August 19-25, soon after which the flight apparently ceased. A common insect.

CENAGRIONINÆ.

5-55 *Enallagma calverti* Morse.

A number of my 1915 captures were labeled by Dr. Walker "♂ *calverti*" and "♀ *calverti* or *cyathigerum*." The insects seem very similar in appearance, season and habits, but the ♂'s appear to differ constantly in the form of the superior appendages. My dates read: teneral ♂'s June 7; adult ♂'s June 24, and a pair, in alcohol, July 2; both fully adult. Another pair taken in cop., July 23. Common.

6-57 *Enallagma cyathigerum* Charpentier.

On the wing early in June and adult by 24th of that month. I have pairs taken in cop., June 25, July 15, July 16. By 4th week in July principal flight was over, but belated individuals appeared later. I took a ♂ as late as August 27. Common.

7-() *Cenagrion angulatum* E. M. Walker.

On July 4 I took a ♂, fully coloured, at Gaetz Lake, flying with *C. resolutum*. Innisfail, July 6, hundreds flying with *resolutum* by stagnant slough. Red Deer, July 8, Gaetz Lake, ♂ and ♀; July 13, ♂ and ♀; July 19, 2 ♂'s; July 22, a ♂. A stagnant slough rather than a considerable body of clear water appears to be the truer habitat of the nymph—which is at present unknown. It was useless to work the slough on the occasion mentioned as heavy rains had fallen. The slough was flooded and all exuviae would have been washed from the reeds. New to the Alberta list.

8-66 *Cenagrion resolutum* Hagen.

First appearance 1916, May 26, tenerals of both sexes. By June 15 in full colour. Numbers in cop., June 25, July 4, July 16, July 19. Shortly after the last date the flight ceased. Common. Gaetz Lake, Red Deer, and Innisfail near stagnant slough.

Æshnidæ.

GOMPHINÆ.

9-85 *Ophiogomphus severus* Hagen.

In 1915 I took a number Aug. 30 to Sept. 7, but more thorough collecting in 1916 proved that *severus* appears in mid-July. My dates are July 13, a teneral ♂; July 14, a ♂; July 17, ♀; July 18, ♀; Aug. 4, 3 ♂'s—one a teneral; Aug. 5, ♂ and ♀; Aug. 6, a

number; Aug. 19, a ♀; Aug. 26 Mr. Horsbrugh saw three. Last date Sept. 10, a young ♂.

This dragonfly frequents sandy roads near the river, and rests on the soil frequently. The beautiful light green of the tenerals is lost in dried or even alcoholic specimens.

ÆSHNINÆ.

10-110 *Æshna eremita* Scudder.

Nordegg (altitude 4,500 ft., 120 miles west), Aug. 10, a ♂; Sylvan Lake (fifteen miles west), Aug. 14, a ♂; Blackfalds (nine miles north), Aug. 19-25, 3 ♂'s; Red Deer, Aug., 24, 4 ♂'s; Aug. 27, 2 ♂ and a ♀; Aug. 29, 2 ♀'s; Sept. 2, 2 ♂'s and 2 ♀'s; a number flying in cop., Sept. 9. Last date Sept. 16, a ♂. Appears to be widespread and fairly common. Adult ♀'s dimorphic, being blue and black like male, or yellow and brown.

11-112 *Æshna interrupta lineata* E. M. Walker.

First flight of tenerals July 1. By July 13 some taken almost adult. July 16 took ♂ and ♀ tenerals at Gaetz Lake with their exuviae. The latter half July, all August and first three weeks Sept., *lineata* swarms everywhere, and up to the 4th week in August (when *A. eremita* appears) the ratio of *lineata* to all other *Æshna* would be at least 25 to 1. Frost at night, Oct. 1 to 7; Oct. 8, a ♀ teneral.

Lateral thoracic bands subject to great variation. I have taken ♂'s with the upper two-thirds of the second band absent; excepting light terminal spots, and others with both bands *slightly* interrupted.

12-111 *Æshna juncea* Linné.

A ♀ teneral in a glade close to southeast corner Gaetz Lake, August 5. There is nothing extraordinary in this record, for *juncea* has been taken in Alberta previously and might well be expected to occur here, but what seems inexplicable is that careful collecting in the same locality failed to produce others.

13-114 *Æshna sitchensis* Hagen.

Red Deer, a teneral ♂, Aug. 2, and ♂, Aug. 11. Blackfalds (9 miles north), Aug. 21, ♀; Aug. 22, ♂; Aug. 23, a ♀ and 2 ♂'s. Last date, Red Deer, Sept. 10, a worn ♂.

On Aug. 6 I searched the reeds at Gaetz Lake for nymphs

but found *A. lineata* only. At Blackfalds, Aug. 23, I took the specimens noted, and saw others (some of which were in cop.) flying over a large muskeg. I incline strongly to the opinion that the true breeding ground of this northern insect is muskeg, which may account for the nymph being still unknown.

14-114 *Æshna umbrosa* E. M. Walker.

Among my 1915 captures Dr. Walker named one *umbrosa*—a ♀. Unfortunately I failed to record data, though it was certainly taken in the Red River District. I naturally expected to take specimens during the past season, but of the dozens of *Æshna* netted for examination, not one *umbrosa*! New to Alberta list, 1915.

Libellulidæ.

CORDULIINÆ.

15-128 *Cordulia shurtleffi* Scudder.

Tenerals appeared June 6, both ♂ and ♀; June 8, 6 ♂'s and 6 ♀'s; June 11, numbers flying; June 17-24, a few still on the wing; July 1, a ♀; July 5, a ♂ and a ♀.

This handsome dragonfly appears to have a very limited season. Practically all the specimens were taken in the sun-lit glades northeast of Gaetz Lake, and I took exuviae in the reeds. New to Alberta list.

16-129 *Somatochlora hudsonica* Hagen.*

I took this insect at one place only, and for a very limited period, viz., flying over a small "run" of still water behind Allen's house, at north end of Gaetz Lake. July 1, 4 ♂'s and 1 ♀; July 2, 1 ♂; July 8, 1 ♂; July 9 saw several and took a ♂.

The males never appeared to rest, but the only ♀ taken was while temporarily at rest on a low bush. I conclude the insects were bred in the "run" over which they flew, but when first observed they were adult. Next June I should be able to obtain the nymph, which is at present unknown.

*I sent drawings of the male abdominal appendages of one of this series to Mr. C. H. Kennedy, who wrote me that it was the same as the *S. hudsonica* in the Hagen collection, M. C. Z., Cambridge, Mass. This is not the species figured by Martin as *hudsonica* in Cat. Coll. Selys, XVII, p. 27.—E. M. Walker.

LIBELLULINÆ.

17-139 *Libellula quadrimaculata* Linné.

Tenerals appeared June 8, 1 ♂. On June 11 I saw three and took a ♀; June 15, took 2 ♂'s and a ♀; June 17, numbers flying; June 18, reeds at Gaetz Lake full of tenerals with exuviae; June 25, many on the wing; July 5, 2 ♂'s; July 9, "none;" July 13, "none;" July 15, 1 ♂; July 16, ♀ (ovipositing); July 23, a few ovipositing; July 29, 2; Aug. 5, a worn ♀; Aug. 6, several very worn ♀'s.

It will be noted that while *C. shurtleffi* and *L. quadrimaculata* appear at the same time, the season of the latter is two months, to one month of the former. I once observed a ♀ ovipositing with a mate hovering by. Twice they went into copula for short periods between spells of ovipositing—which, however, she performed alone. New to Alberta list.

18-160 *Sympetrum corruptum* Hagen.

A strangely rare insect considering the length of its season, as shown by the dates of the only five specimens taken in this district in two years, viz., June 20, 1916, Sylvan Lake (Horsbrugh), a ♂ nearly adult; July 8, 1916, Red Deer, a ♂; Aug. 5, 1916, Red Deer, a ♀; mid-Aug., 1915, at Blackfalds, a ♀; Sept. 4, 1915, Red Deer, a ♀ teneral.

Assuming that June 20th specimens had been on the wing since June 15, and the Sept. 4 teneral would have lived until Sept. 15, it would give a season of three months. Four of my captives were taken on roads, and the fifth on a railway grade.

19-161 *Sympetrum costiferum* Hagen.

Aug. 5, a ♀; Aug. 6, a ♀; Aug. 13, many flying alone and in cop.; Aug. 29 to Sept. 24, "numbers," and fresh tenerals. Last date Sept. 30.

Costiferum is probably rather less numerous than either *S. rubicundulum* or *S. scoticum*, but very common nevertheless. It is the last of the genus to appear, but I fancy it may have been on the wing slightly earlier than my first date. New to Alberta list.

20-162 *Sympetrum obtrusum* Hagen.

Dr. Walker named one of my 1915 captives *obtrusum*, and it possibly occurs here in fair numbers. I must confess, however, that I find difficulty in satisfying myself positively by the genital

organs, that specimens which might be *obtrusum* from general appearance (olive green ♀ colouration, white faces, etc.) are anything but *rubicundulum*.

21-163 *Sympetrum rubicundulum decisum* Hagen.

First appearance, 1916, July 2, 2 ♀ tenerals; July 4, a ♀; July 5, 1 ♂ and 3 ♀s—the ♂ showing red; July 8, "a number," and by July 13, common everywhere. Observed in cop., July 16. The main flight of *rubicundulum* was practically over by the end of August, but belated individuals to mid-September.

Yellow-winged ♀s are quite common. I have specimens July 5 to Sept. 10. The colouration varies from light yellow to the brown of a nicotine stain.

22-163 *Sympetrum scoticum* Donovan.

July 17, first flight of tenerals; July 23, "numbers." Tenerals still appearing. Aug. 24, (on which date I took a teneral with exuvia) but by this time many of the earlier flight were black adults. Sept. 2, adults flying in hundreds, and continued during month. Last date Oct. 12.

Scoticum is a very common insect in this district. Ovipositing is performed by rapidly dipping the tip of abdomen in shallow water in the reeds. During the operation the male retains hold by appendages and appears to take an intelligent interest—the pair moving in perfect accord from one patch of open water to another. I have never seen ovipositing performed alone.

23-166 *Leucorrhinia borealis* Hagen.

The first flight of tenerals appeared May 26, and they continued emerging until mid-June, by which time the early insects were adults, and flying in hundreds. By the end of June the numbers had much decreased, but belated individuals dragged well into July—my last record being July 20, 2 ♀s. Mr. Horsbrugh took a teneral at Camrose, May 19. Adult males are blood-red, and old females also take a reddish tinge. Mid-June I took at Gaetz Lake an exuvia with teneral, and a number of exuviae without. The nymph was previously unknown. The insect selects an average height of four or five inches from the water to transform.

24-166 *Leucorrhinia glacialis* Hagen

On July 5, Mr. Horsbrugh took for me at a slough north, across the river, a number of what at first glance appeared to be

L. proxima—which insect we had been taking for the previous ten days. A closer examination of the specimens, however, failed to show any trace of a spot on segment 7, and they were later forwarded “*glacialis?*” to Dr. Walker for determination. This diagnosis he has confirmed.

From my *proxima* dates I judge the season of the allied species to be almost, if not quite, identical—a point well worth further investigation next year. New to Alberta list.

25-166 *Leucorrhinia hudsonica* Selys.

Tenerals appeared with *L. borealis* May 26, and its season is almost identical. By June 17 males are adult and red, and females reddish. The flight wanes in early July—my final records being as follows: July 2, red ♂; July 4, a teneral ♀; July 5, several pairs in cop.; July 9, saw one; July 13, “none;” July 18, a worn ♀; July 29, a young ♂; Aug. 1, a ♂, red and worn.

In June, *hudsonica* is very common, but possibly rather less so than *borealis*, which it closely resembles in everything except size. I took exuviae rather closer to the water than *borealis* selects.

26-167 *Leucorrhinia intacta* Hagen.

On June 24 I took two young ♂'s, the twin-spot on segment 7 being bright yellow. July 14, a ♀; July 15, 3 ♀'s; July 20, a fine adult ♀.

The above were my total captives. So *intacta* is clearly not common—in fact rather rare. It is also the latest of the genus to appear, being a month behind *borealis* and *hudsonica* and a week behind *proxima* (and *glacialis?*). From my dates it is obvious that for several weeks—say June 24 to 3rd week July—all five *Leucorrhinia* are on the wing together. One of the ♀'s taken on July 15, has wings heavily clouded with dirty brown. New to Alberta list.

27-167 *Leucorrhinia proxima* Calvert.

First appearance June 17 when I took a teneral with exuvia, and another, a ♂, next day. June 24, took 2 ♂'s, already showing red markings, and a pair in cop., June 25. July 5, several; July 6, 1 ♂; July 23, 2 old ♂'s.

Proxima is far less common than *borealis* and *hudsonica* and appears about three weeks later. The nymph was previously unknown. New to Alberta list.

**PLAGIODERA VERSICOLORA LAICH.—AN IMPORTED
POPLAR AND WILLOW PEST.**

BY HARRY B. WEISS AND EDGAR L. DICKERSON,* NEW BRUNSWICK, N.J.

For the past three years the writers have noticed this small, metallic blue beetle infesting poplars in a nursery at Irvington, near Newark, N.J., and since it was first noted at Irvington, it has been observed in several other localities. Mr. Charles Schaeffer (Journal N. Y. Ent. Soc., Dec., 1915) cites several collectors who found it on Staten Island, and Mr. William T. Davis (Ent. News., Mar., 1916) also records it from Staten Island; Mr. George Greene, of Philadelphia, states that he found it at Clifton, Passaic County, N.J., in September, 1915, while the writers noted it in 1915 at Arlington, N.J., and Elizabeth, N.J., as well as Irvington, (Can. Ent., March, 1916, and Ent. News., April, 1916). During the past season—1916—it was also observed at Secaucus, Red Bank and South Paterson. At the latter place the species was found very abundant on willow.

The insect is a European species, and according to Mr. E. A. Schwarz, of Washington, was described by J. N. von Laichartig in *Verzeichniss und Beschreibung der Zyröles Insecten*, 1781–1784, under the name *versicolora*, which is an older name for the common European *P. armoricæ* of Fabricius. It is interesting to note in passing that Fabricius (Syst. Ent., p. 103) records *P. armoricæ* as occurring on *Ranunculus aquatilis* and *flammula*, which looks as if *P. armoricæ* Fabr. might be a different species, unless perchance the insects fed on willow near water and dropped on the *Ranunculi* from which they were collected. There is further synonymy indicated in the various European records, but that need not be discussed here.

In New Jersey the species has been noted by the writers in greatest numbers at Irvington, in a nursery on poplar and at South Paterson on willow, and the following observations were made at these places, principally at the former.

The beetles came from hibernation in late April or early May, and after feeding began oviposition in early May and continued through the greater part of that month. By early June the adults

*The arrangement of the authors' names has no significance, and indicates neither seniority nor precedence.

of this brood had apparently disappeared and all eggs had hatched. The first adults developing from this brood of eggs were noted June 10, and they continued to develop until the early part of July. The first eggs were deposited by the second brood of beetles about July first and oviposition continued until the early part of August. The adults developing from this brood of eggs began to appear in the latter part of July and continued to develop until late August, after which time, after feeding and copulating, they disappeared from the plants, having gone into hibernation.

Hibernation, according to Messrs. Leng and Davis occurs under the loose bark or in crevices in the bark, as they have found them abundantly in such situations on Staten Island. Mr. Leng states that while collecting *Parnidæ* in a pond at Bull's Head, Staten Island, he picked up a piece of willow bark in the water and found several specimens of this species attached to it.

It will thus be seen that there were three broods of beetles during the season, a hibernating brood which appeared in spring and continued in evidence during May, a second brood which began to be in evidence about June 10 and continued to appear until well along in July, by which time the third brood of beetles had begun to mature, and this brood continued in evidence until late August or early September. Thus there were two complete broods of insects in addition to the hibernating beetles. Owing to the fact that the insects apparently lived for some time after maturing, and that the period of oviposition of a given brood extended for some time, with a resulting irregularity in development, there was more or less overlapping of the broods.

It will also be noted from the foregoing record that it required about a month's time for the insects to mature, but this will probably vary a few days one way or the other depending upon conditions of temperature, food, etc. The length of the egg stage varied from three to five days, and the early stages of the larva were observed to occupy about the same length of time, while the period of pupation consumed two to three days.

The eggs of this species are laid in somewhat irregular masses, more or less circular or oval in outline and, almost without exception, on the underside of the leaves. Usually only one mass occurs on a leaf but occasionally there may be two, and they are situated

on either side of the midrib near the centre of the leaf. The individual egg is lemon yellow in colour with an apparently smooth surface. It is elliptical or narrowly oval in outline with broadly rounded extremities and measures 0.95 mm. long by 0.45 mm.—0.55 mm. broad. Each egg is attached to the leaf surface at one of its extremities and inclined usually at an angle of 30 degrees. At the attached end there is a thin, irregularly disc-shaped expanse of material which fastens the egg to the leaf surface. A number of egg masses were observed and the numbers of eggs in 22 masses were counted with the following results:

Maximum number.....	30
Minimum " 	12
Average " 	19+

Two other unusually small masses were noted which contained five and seven eggs respectively.

As the egg matures, the three pairs of dark spots on the thoracic dorsal surface and the dark spots on the abdominal, dorsal and lateral surfaces of the embryonic larva show distinctly through the egg shell. Previous to the emergence of the larva the shell of the egg splits along the lateral surface from the apical end half way, or slightly more, to the base and the larva gradually works its way through this opening. When the larva first emerges, it is dirty white in colour but changes very rapidly on exposure and soon is dark in appearance.

Five larval stages were observed as follows.—*First stage*: recently emerged larva; body elongate tapering posteriorly; general body colour dirty white; head, and dorsal and lateral surfaces of prothorax black, legs and body at outer side of legs dark brown; meso- and metathorax, each with a pair of dorsal black spots and single dorsolateral tubercles. Each abdominal segment marked dark brown as follows: a pair of prominent dorsal spots, a pair of lateral prominent spots, with a smaller dot more or less connecting them, three less prominent transverse ventral spots forming a broken line. On the posterior abdominal segments the dorsal and lateral spots are connected, forming longitudinal bands. Dark spots on dorsal and lateral surfaces bearing one or more fine, comparatively long hairs and the latter also noted on head and thorax. Width of head 0.3 mm.; length of body 0.9 mm. *Second stage*:

somewhat similar to 1st stage, general body colour yellowish brown, dark spots on dorsal surface forming more or less longitudinal lines. Thoracic tubercles more prominent, and two lateral rows of abdominal spots becoming tubercles and dorsal spots on abdomen becoming slight tubercles. Hairy condition of larva slightly more pronounced. Width of head 0.4 mm.; length of body 1.7 mm. *Third stage*: similar to second stage save that the colour, with the exception of the legs, is darker, so that the dorsal surface has a brownish appearance with a light, medial dorsal line on the thorax. Tubercles more prominent and slightly roughened. Width of head 0.5 mm.; length of body 2.5 mm. *Fourth stage*, similar to third stage, save that tubercles and colour are slightly more pronounced. Width of head 0.7 mm.; length of body 3 mm. *Fifth stage*: body elongate, tapering at posterior extremity; margins of prothorax, medial dorsal line of thorax and under surface, yellowish brown. Head shining black and bearing several long setæ; front and vertex depressed; prothorax with most of dorsal surface shining, dark brown, lighter medially and laterally; bearing a few setæ on lateral margins; mesothorax brown, lighter medially, on either side of which are two shining, dark brown spots; lateral margin of dorsum has a prominent, dark brown tubercle with two dark brown, shining spots posterior to it and two below it; metathorax similar to mesothorax; abdomen brown, a double row of dark spots on the dorsum, a double row of shining, dark brown tubercles on each side with a single row of dark brown spots between them; under surface of abdomen with five rows of brownish spots, the three median ones lighter than the others; legs shining black; anus surrounded with a prominent, yellowish, fleshy, circular, sucker-like disc. Width of head 0.8 mm.; length of body 5.00 mm.

The tubercles noted on the sides of the thorax and abdomen contain reversible hypodermal glands which are operated when the larvæ is irritated, even in the recently emerged ones. The larvæ of *Plagiodesma* do not respond as readily as do those of *Lina scripta* Fab. which also bear such glands. On the latter species there is a minute drop of liquid exuded which is not the case in *Plagiodesma* and the odor is much more pungent.

The sucker-like disc at the anal end is used by the larva in walking. Even in the recently hatched larva this disc is well de-

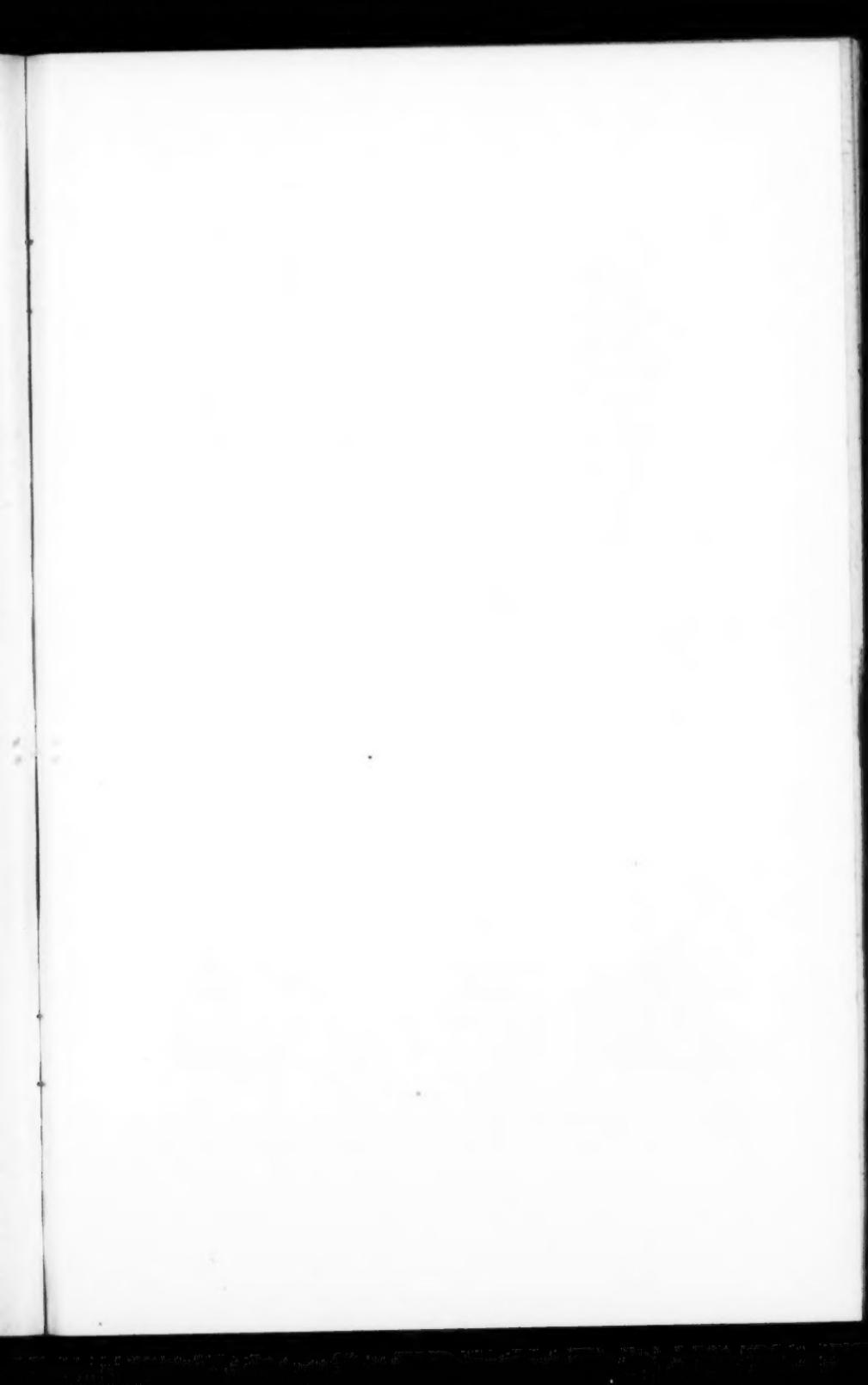
veloped and is quite apparent while the larva is emerging from the egg. It is the principal means of attachment for the newly hatched larva, which is able to hold much more firmly with it than with the legs.

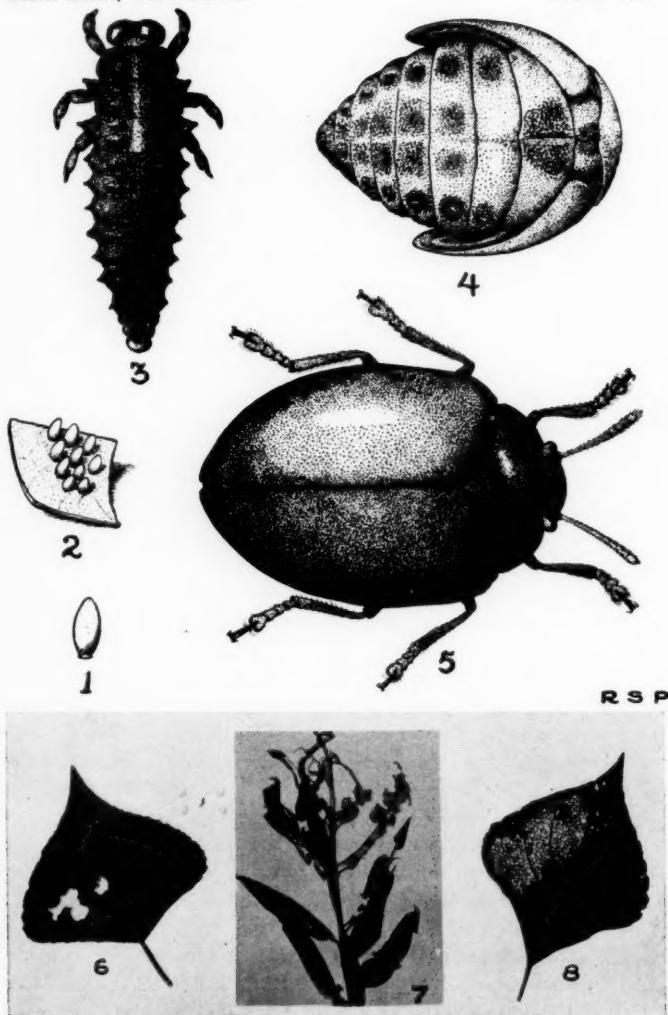
In feeding, the young larvae are gregarious as a rule and frequently may be observed arranged in the form of a circle or arc with the heads pointed outward. Larval groups of 10, 13, 11 and 16 were thus observed. Later the larvae spread and usually feed singly. They are found as a rule on the under surface of the leaf but in confinement, and in shady places they were observed sometimes feeding on the upper surface. In feeding, only the epidermis is eaten, and this is in contrast with the adult which consumes all the tissue. At times there did not appear to be as many young larvae in a group as one would expect from the number of eggs in a mass, and this may be explained by the fact that recently emerged larvae were observed feeding on eggs which had not yet hatched; three were feeding on one egg, two on another, and two others on one each.

When full grown the larva attaches itself to the leaf, usually the under surface, by means of the sucker-like disc at the anal extremity, and changes to the pupa which rests with its posterior end within the cast skin of the larva from which it could be pulled with little effort. This stage was found to cover a period of two to three days.

The pupa is yellowish brown in colour; meso- and metathorax dark at centre; margin of wing-pads dark; abdomen with a row of broad dark spots on either side of centre, giving the effect of a light, medial, dorsal line; beyond these is a second row of broad, dark spots near the lateral margin. Length 4 mm.; width 2.5 mm.

Certain pupae were noted which did not rest close to the leaf surface and upon examination these were found to be parasitized. These pupae were in a more erect position and it was noted that the anterior ventral surface was more or less broken, exposing from two to four parasitic larvae or pupae. Parasites bred from such specimens were kindly determined for us by Mr. Girault, of the Bureau of Entomology, as *Calopisthia rotundiventris* Girault and *Pleurotropis tarsalis* Ashmead, and judging from the condition of the specimens when they were bred, the former is a primary parasite





PLAGIODERA VERSICOLORA LAICH.

(See p. 109)

and the latter a hyperparasite. A number of parasitized pupæ were noted but they were not evidently abundant enough during the past season to form any appreciable check on the insect.

At Paterson, N.J., a number of rather small pupæ were noted. As they were late in developing and undersized it was thought that development might have been affected by parasitism. This proved, however, not to be the case, as beetles were reared from practically all that were collected.

In addition to the parasites a predaceous bug was observed attacking this insect. An adult beetle was found with three nymphs of a species of Heteroptera attached to it. One had the lancets of the beak inserted at the left eye, a second at the tibio-femoral articulation of the left posterior leg, and a third between the last and the preceding ventral segment. At other times dead larvæ were noted and it may be that these also had been attacked by a similar predaceous species.

Owing to the fact that *Lina scripta* Fab. is found associated with this species it is interesting to note some differences between the two. Differences in the glands occurring in the larvæ have already been mentioned, but the larvæ also differ in that *L. scripta* Fab. is somewhat darker than *P. versicolora* and of course attains a larger size. The resulting pupa is also larger than that of *P. versicolora* and hangs from the lower surface of the leaf, attached only at the anal end of the body. The eggs of *L. scripta* Fab. are somewhat similar but the mass is somewhat larger and composed of a larger number of eggs, 60 to 70 having been observed in some masses, while the individual egg is larger and of a light lemon-yellow colour.

EXPLANATION OF PLATE VII.

- Fig. 1. Egg.
- Fig. 2. Small egg mass.
- Fig. 3. Fifth stage larva.
- Fig. 4. Dorsal view of pupa with wing-pads slightly extended.
- Fig. 5. Adult, *Plagiodesma versicolora*.
- Fig. 6. Lombardy poplar leaf, showing beetle feeding. (Photo by H. Hornig.)
- Fig. 7. Willow foliage injured by beetles and larvæ.
- Fig. 8. Lombardy poplar leaf, showing larvæ feeding. (Photo by H. Hornig.)

TWO NEW GENERA OF NORTH AMERICAN
ENTEDONINÆ (CHALCID-FLIES).

BY A. A. GIRAULT, GLENDALE, MD.

Elachertodomyia, new genus.

Type.—*Secodes phlaeotribi* Ashmead.

Tarsi 5-jointed; hind tibial spurs double; antennæ inserted slightly above the ventral ends of the eyes, 13-jointed, 3 ring, 5 funicle joints, the three club joints not very distinctly divided, especially the small last, the latter without a terminal spine. Funicle joints all somewhat wider than long, the first longest, slightly shorter than the normal pedicel. Head rounded from cephalic aspect. Venation normal, the marginal vein a little over two-thirds the length of the submarginal, the postmarginal elongate, nearly as long as the marginal, twice the length of the short stigmal, the stigma being larger than usual. Several lines of the fine discal ciliation, notably one from the stigma to blade apex, regular and distinct. Parapsidal furrows distinct. Propodeum short. Scutum long. Scutellum subquadrate, its lateral margins delicately indented, appearing as lateral, grooved lines but not these as usually understood. Scutellum with not more than four bristles. Strigil strong, the cephalic tibial spur forked. Propodeum with a weak median carina. The original description of the genotype is correct. Its body is scaly.

From the female type of genotype, now remounted on a tag in the U. S. National Museum, the antennæ, a fore wing, a middle tarsus and a hind leg together on a slide.

This genus is certainly very anomalous. I doubt if it is an euplophid, because of its two hind tibial spurs, the forked tibial spur of the cephalic legs and the five tarsal joints.

Emersonopsis, new genus.

Type.—*Entedon arizonensis* Ashmead.

Original description correct. All the tarsi concolorous. Antennæ 9-jointed with two rather large ring-joints, the club 3-jointed, the funicle 2-jointed, club with a short, terminal nipple. Pedicel much longer than wide, slightly longer than funicle 1; funicle 2 subglobular. Postmarginal vein shorter than the very short, sessile stigmal. Propodeum medially produced into a neck like the abdominal petiole, the latter very short and ventrad of the

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former. Propodeum with a broad, smooth, median carina which runs only to the base of the neck; on each side of it a flat groove which is densely, finely scabrous like the surface of the neck, and bounded by a delicate carina laterad; a quadrate area laterad of this carina is divided obliquely into a glabrous half-area (cephalo-mesad) and a half-area which is foveo-sulcate; this is really formed by a lateral groove narrowing mesad which extends laterad from the apex of the groove alongside the median carina, and then cephalad to a point just mesad of the spiracle; therefore, there is a lateral carina which forms the lateral and caudal margins of this groove, and extends besides some distance down the neck of the propodeum. This groove really encircles (cephalad) the spiracle. Hind coxae scaly (dorsal aspect). Face with a X-shaped suture, the point of crossing at about the apex of the scrobes, scaly ventro-laterad of each antenna. The latter are inserted at about the ends of the eyes. A suture leads from the cephalic ocellus to the point of crossing of the diagonal ones. Occiput finely scaly.

The second segment of the abdomen occupies three-fourths of the surface. The propodeum is nearly as in *Pseudomphale*.

From the female type in the U. S. National Museum on a tag.

Type.—Catalogue No. 13145 U. S. N. M.; plus a slide with antennae and pair of wings.

THE INSECT COLLECTIONS OF CANADA.

BY A. F. WINN, WESTMOUNT, P.Q.

At the annual meeting of the Entomological Society of Ontario, held at Guelph in November last, instead of adding a presidential address to the already lengthy programme, I made a few remarks on the Insect Collections of Canada, and suggested that it might be of interest not only to the members of the Society but also to many living beyond our borders to know just where the various collections, public and private, are situated and something about what they contain.

The idea seemed to meet with the approval of the meeting, and the Editor was willing to find space in the pages of "The Canadian Entomologist" for a series of articles describing briefly any collections of which data could be obtained; the descriptions might include mention of any notable varieties or types, collec-

March, 1917

tions from out of the way localities, desiderata whether by exchange or otherwise, and perhaps in some cases be illustrated by half-tone cuts of the museum or room in which they are housed.

It is hoped that all our members will co-operate, so that the series, when complete, will really be contributed to by everyone who has a collection. Our Society is unique in having its Branches and individual members scattered over such a wide area, and if this series of articles is helpful in bringing the members from Halifax, N.S., to Victoria, B.C., into closer touch with one another, one of its objects will have been attained.

It seems fitting that the first article should deal with the collections of our Society at its headquarters at Guelph, and the Rev. Dr. Bethune has kindly consented to write it. So far as practicable other articles will appear in order geographically from east to west—the collections in the Maritime Provinces next, followed by the Province of Quebec, and so on westward. It is not at all necessary that the same plan of describing the collections should be adopted throughout the series; on the contrary the more individuality about them the better, but for the benefit of visiting entomologists it is desirable that no collection should be overlooked, and that the owners should not be so modest as to hesitate about having their treasures referred to in print.

At this most critical time in our history every topic discussed leads to the subject of the war, and there is no doubt that when the end comes and peace reigns again there will be a great demand for insect material from Canada, especially from the entomologists of the British Isles, which we will more cheerfully than ever supply if it be in our power. There must also be, unfortunately, scores of enthusiastic collectors in Belgium, in France and in Poland whose homes have been laid waste by the enemy and whose collections have been absolutely destroyed. Of those who return most will, in their spare minutes, turn from their hatred of man to the love of nature and will at once begin to form new collections. To any such, it is hardly necessary to say that the entomologists of Canada will be found ready to send any material they have, or can obtain, that will be of interest in connection with their studies.

Mailed March 10th, 1917.

